AD-A177 077 EFFECTS OF STATISTICAL DEPENDENCE(U) ILLINOIS UNIV AT URBANA K JOAG-DEV 1985 AFOSR-TR-87-0286 AFOSR-84-0200 1/1

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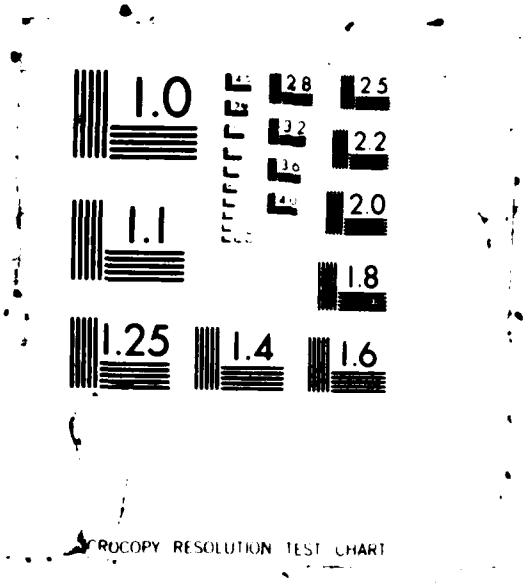
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FINAL PROJECT REPORT 1984-85

AFOSR 84-0208

Kumar Joag-dev, Principal Investigator

Professor Joag-dev had been carrying out research on reliability theory and related probability in equalities for several years. Professors Proschan and Dharmadhikari are his co-workers. One type of work is on certain inequalities which have potential applications in quality control. In many systems, the relevant quantity to be measured may not be normally or even symmetrically distributed. Consequently, the target value may be neither the mean nor the mode, but we have found some results which will throw some light on bounds for the survival probabilities in such cases. Two papers have been prepared on this topic. One of these was presented at the Columbia, Missouri conference on reliability and quality control in the summer of 1984. It will appear in the Proceedings of the Conference. The second paper which considers bivariate aspects of the problem has been accepted for publication in a refereed journal.

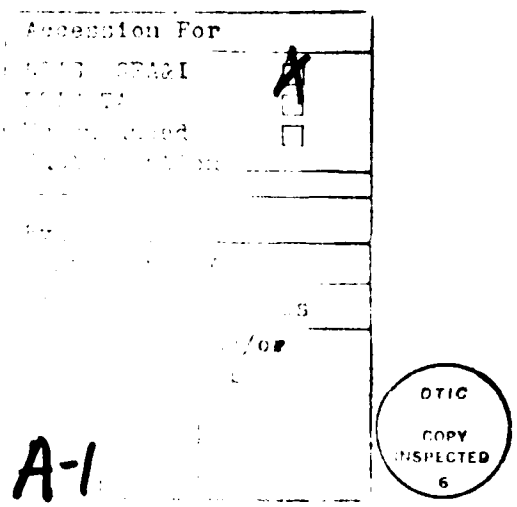
Another type of work is on concepts of dependence for multicomponent systems. Such dependence arises naturally in reliability work because of common environmental factors and common sources of material. Some of Professor Joag-dev's work in this area is carried out jointly with Professor Proschen. A paper containing results related to negative association will appear in 1985-86. Work was also carried out on a comprehensive review article on concepts of dependence for inclusion in the reliability volume of the HANDBOOK OF STATISTICS. This article mainly explores modes of positive dependence for bivariate and multivariate age distribution. It also studies some results in renewal theory which are important in looking at maintenance and replacement policies for systems.

It is well known that concepts of convexity play an important role in reliability work. Most of the classes of life distribution based on notions of aging used the mathematical framework of convexity. We have prepared a short article illustrating the use of convexity in constructing certain types of maximum likelihood estimators. This paper was accepted for publication during 1984-85.

Work has also been carried out on a research level monograph on unimodality and convexity. The monograph brings together work in this area that is scattered in diverse journal articles. To the best of our knowledge this is the first unified work on unimodality. This would complement the recent monograph by Tong on probability and inequalities and one by Marshall and Olkin on majorization. Several of our professional colleagues have expressed interest in the work. There is much material here that is useful to workers in reliability theory. There is a chapter on convexity in reliability theory. There is also material on applications to multivariate analysis, estimation of mode, order statistics, etc., which are useful in many problems of life testing. A prepublication draft of the monograph was close to completion at the end of June, 1984.

Professors Joag-dev and Dharmadhikari attended two conferences. As already mentioned, a paper was presented at Columbia, Missouri. Two more papers were presented at the workshop arranged by the Air Force Office of Scientific Research at Skyland, Virginia in May, 1985. One of these considered the model proposed by Freund in which a failure of one component put a stress on the surviving components. The relevance of this model in reliability is brought out by the fact that many papers have been written

on it. However, existing estimates of parameters of such a system does not adequately account for the natural constraint on the parameters. Research is now being done to improve the estimators to fit these natural constraints. The second paper presented at Skyland treated a family of distributions by using an ordering which is extremely relevant in studying age distributions.



References

A. Paper published

1. Dharmadhikari, S.W. and Joag-dev, K. (1985), Examples of nonunique maximum likelihood estimators, Amer. Statistician 39, 199-200

B. Papers accepted for publication

2. Dharmadhikari, S.W. and Joag-dev, K. (1984), The Gauss-Tchebyshev inequality for unimodal distributions, To appear in Theory of Probability and its Applications.

3. Dharmadhikari, S.W. and Joag-dev, K. (1984), Some results on generalized unimodality and an application to Chebyshev's inequality, To appear in the Proceedings of the Conference on Reliability and Quality Control, Columbia, Missouri

C. Other material due to appear

4. Chaganty, N.R. and Joag-dev, K., Dependency Concepts in Reliability Theory, To appear in Volume 6 of the Handbook of Statistics, (P.R.Krishnaiah Editor), North Holland.

D. Other papers completed or being completed

5. Joag-dev, K. and Proschan, F. (1985), A negative result about some concepts of negative dependence, FSU Statistics Report M703.

6. Joag-dev, K. and Proschan, F. (1985), On a covariance inequality for a coherent structure, FSU Statistics Report, submitted for publication.

E. Monograph close to completion

7. Dharmadhikari, S.W. and Joag-dev, K., Unimodality, Convexity, Inequalities and Applications. This monograph should be finished very soon and is expected to be published by Academic Press.

F. Work under progress

8. Joag-dev, K., Association of matchmakers, under prepararion.

END

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